APPENDIX A

SPECIFICATIONS and PLATES

1. STABILIZED GRAVEL BASE

SCOPE:

These specifications cover the construction of a stabilized road surface. The intent is to provide a surface other than asphalt or concrete that will withstand moderate traffic with reasonable maintenance. The specifications are based on a compacted crushed gravel and fines mixture placed on a compacted subgrade with adequate drainage provided.

DRAWING:

Design drawings showing plan, profile, contours, drainage and typical section prepared by a licensed engineer, shall be submitted for approval by the Planning Board, as part of the Definitive Plan submission.

TYPICAL SECTION:

The road section shall conform to Plate No. 6 "Stabilized Road, Typical Section." Note that the graveled width shown is 20 feet. The Planning Board may authorize less than 20 feet in individual cases in which case turn-outs must be provided in each straight section or every 1,000 feet, whichever is less.

DRAINAGE:

The road surface shall be graded and pitched to conduct surface water to catch basins, run off ditches, leaching pits or fields, sized and located to handle the maximum rain storm with a five year frequency. The following table, based on United States Weather Bureau data, may be used for this purpose.

Rainfall: Intensity – Duration -- Nantucket 5-Year Frequency

Rainfall Intensity In 1 Hour	Duration (hours)	Total Fall (gal/ sqare ft.)	Rate (gpm/ square ft)
4.00	0.10	0.250	0.0417
3.00	0.22	0.413	0.0313
2.00	0.50	0.623	0.0208
1.00	1.70	1.065	0.0104
0.80	2.30	1.150	0.0083
0.60	3.70	1.380	0.0062
0.50	4.70	1.470	0.0052
0.40	6.40	1.600	0.0042
0.25	13.00	2.030	0.0026
0.20	17.00	2.120	0.0021
0.15	23.00	2.150	0.0016

*Frequency analysis by method of extreme values, after Gumbel.

SUBGRADE:

Topsoil, loam, peat or other unsuitable material shall be removed. The subgrade shall be graded and compacted to designed grade. Fill material shall be approved hardening and sand mix. Compacting shall be by approved rubber tired or vibrating roller compactor.

SHOULDERS:

Shoulders shall be graded to designed grades, raked and seeded with the following seed mixture applied at the rate of 100 pounds/acre:

	Proportion	Germination Minimum	Purity Minimum
Creeping Red Fescue	50	85%	95%
Kentucky 31	30	85%	95%
Domestic Rye	10	90%	98%
Red Top	5	85%	92%
Ladino Clover	5	85%	96%

SURFACE COURSE:

The surface course shall consist of 6 inches of mix of which 35 percent of the mix shall be 3/8 inch to 3/4 inch size crushed stone and 65 percent crushed stone fines and silts. The stabilized gravel road surface shall meet the following sieve analysis D or F.

	Percent by Weight (dry) Passing Square Mesh Sieve	
Sieve Size	D	F
1 inch	100	100
3/8 inch	60 – 100	60 – 100
No. 4	50 – 85	70 – 100
No. 10	40 – 70	55 – 100
No. 40	25 – 45	30 – 70
No. 200	10 - 25	8 - 25

Maximum liquid limit 35 percent for portion passing #40 sieve.

Plasticity index 4 to 9 percent for portion passing #40 sieve.

Gravel to contain not less than 75 percent of fractured particles. A fractured particle is one with at least one fractured face and in which the total fractured face area exceeds 25 percent of the maximum cross section of the particle.

Moisture shall be added as required to obtain distribution and binding of fines and gravel. The gravel fines and moisture shall be thoroughly mixed, placed, graded and compacted to specified thickness, pitch and grade. Compaction shall be by roller type equipment approved by the Board or its Agent.

QUALITY OF WORK:

All work and material shall be to the satisfaction of the Board or its Agent.

2. STONE SEAL SURFACE TREATMENT

SCOPE

These specifications cover the construction of a bituminous surface that results from an application of bituminous binder and cover aggregate to existing paved surfaces.

MATERIALS

1. Emulsified Asphalt - Catonic C.R.S.-2 conforming to ASTM D2397-71.
2. Cover Aggregate - The cover aggregate shall be blue quarry stone or approved equal with 70 percent fractured face.

It shall be thoroughly clean and free from deleterious matter. It should be essentially one size, sharp and mostly conform to the following gradation requirements as determined by California Test Method No. 202.

Sieve Size	Percent Passing Medium 3/8" x No. 6
1/2"	100
3/8"	90-100
1/4"	45-70
No. 4	5-30
No. 8	0-10
No. 16	0-5
No. 200	0-2

Screening shall be non-cubical in nature and shall also conform to the following quality requirements:

Test	California Test Method No.	Requirements
Loss in L.A. Rattler Test		
(after 100 Rev.)	211	100% Maximum
(after 500 Rev.)	211	40% Maximum
Film Stripping	302	25% Maximum
Cleanliness Value	227	75% Maximum

Each contractor shall submit a 10 pound sample of screenings proposed to be supplied. Samples which, in the opinion of the Board or its Agent, would result in excessive stripping shall be rejected.

CONSTRUCTION EQUIPMENT

1. **Bituminous Distributor**: The distributor shall be capable of applying the emulsion at the specified rate.

2. **Aggregate Spreader**: Only spreaders shall be used that are capable of spreading the cover aggregate at a uniform and specified rate.

3. **Rollers**: Self propelled pneumatic tired rollers equipped with not less than seven wheels on two axles so that the rear wheels are staggered with respect to those in front, shall be used. Rollers shall weigh not less than 10 tons. Tandem steel rollers shall also be used. Each roller used shall weigh not less than 5 tons or more than 8 tons.

CONSTRUCTION

The construction of a chip seal shall conform to Mass. DPW Specifications and Asphalt Institute Specifications as follows:

1. **Preparation of Existing Surface**: The existing surface shall be cleaned and repaired where necessary. Immediately before work begins the existing surface shall be carefully cleaned with a power sweeper, or otherwise scraped or cleaned to remove all foreign material. Pavement patching and leveling courses shall be completed prior to stone seal application. All cracks shall be sealed prior to application of emulsion.

2. **Application of Emulsion**: The pre-determined quantity of binder shall be sprayed uniformly onto the prepared surface.

3. **Application of Aggregate**: A uniform application of the pre-determined quantity of aggregate shall immediately be spread over the emulsified asphalt binder. Chip spreader never to be more than 50 feet behind the distributor.

4. **Rolling**: Rolling shall begin immediately after stone chips are spread and continue until at least two rollings have been completed over the entire width of each pass of the chip spreader. Rollers shall never be more than 100 feet behind the chip spreader.

5. **Traffic Control**: During construction and 24 hours following construction, vehicle speed should be posted to a maximum of 25 miles per hour. One lane of traffic shall remain open to vehicles at all times.

QUALITY CONTROL AND INSPECTION

The applicant shall allow the Board or its Agent free access to all construction activities so the rates of application and amount of rolling may be closely supervised and inspected to ensure that proper methods are being adhered to.

1. **Aggregate**: The aggregate shall be washed to insure clean material. Immediately after the aggregate has substantially dried from the washing process, the stone shall be sprayed with a coating of CSS-1h at a rate of 3 gallons per ton of aggregate.

2. **Temperature of Emulsion**: Temperature of asphalt emulsion at the time of application shall be not less than 130 degrees F nor more than 180 degrees F.

3. **Latex Rubber Additive**: It is required that the latex be added at the refinery or terminal, since mixing is faster and it allows more time for the latex to blend with the asphalt before application. A certificate of compliance shall be required by the refinery or terminal ensuring the required rate of application. The latex addition should be at a rate of 3.0 gallons per 100 gallons of emulsion.

4. **Weather:** The minimum temperature shall be 60 degrees F and rising, with no rain predicted.

5. **Sweeping**: Excess aggregate should be broomed off the day after application, as early in the morning as possible.

APPLICATION RATES

Asphalt emulsion shall be applied at the rate of 3/10 gallon per square yard. Stone chips shall be applied at the rate of 23 to 25 pounds per square yard. At intersections, stone chips shall be applied at the rate of 25 to 30 pounds per square yard.

3. BITUMINOUS CONCRETE - HOT MIX

SCOPE

These specifications cover the construction of bituminous concrete - hot mix for roadway construction. The bituminous concrete shall be in accordance with these specifications, and shall conform to the lines, grades, thickness, and typical cross-sections as shown on the plans.

MATERIALS

Bituminous Concrete shall conform to the Massachusetts Department of Public Works Standard Specifications and supplemented as follows;

Bituminous concrete mix shall be Type I-1. The mix shall meet the appropriate job mix formulas as per MDPWSS Section M3.11.

Deliver the mixture to the job site at a temperature governed by the air temperature in the shade and away from artificial heat, as follows with a tolerance of plus or minus 20 degrees F:

Normal Layered Construction:

Air Temperature	Delivered Mix Temperature
35 degrees F	300 degrees F
40 degrees F	290 degrees F
65 degrees F	280 degrees F
90 degrees F and over	275 degrees F

Deep Lift Paving (3 inches and over), Base and Binder Courses only:

Air Temperature	Delivered Mix Temperature
35 degrees F	280 degrees F
40 degrees F	270 degrees F
65 degrees F	260 degrees F

EXECUTION

The construction methods required for the construction of bituminous concrete shall conform to the appropriate provisions of the Massachusetts Department of Public Works Standard Specifications for Bridges and Highways.

4. EMULSIFIED ASPHALT MIX - TYPE 1
5. CUT-BACK ASPHALT MIX - TYPE 1

SCOPE

These specifications cover the construction of Emulsified Asphalt Mix and Cut-Back Asphalt Mix. A certificate of compliance shall be provided before any material is placed. The source of material shall be approved by the Board or its Agent.

MATERIALS

1. Emulsified Asphalt: The following grades of emulsified asphalt will be acceptable as specified in ASTM-D977 and ASTM-D2397 for the types of construction listed.

Type of Construction	Grades
Plant Mix (Hot)	MS-2h, HFMS-2-h
Plant Mix (Cold)	SS-1, SS-1h, CSS-1, CSS-1h

Note: "Mix-in-place" method of producing the Emulsified Asphalt or Cut-Back Asphalt will not be acceptable.

2. Cut-Back Asphalt: Cut-Back Asphalt shall be made with grade ML-800 as specified in ASTM-2027 and AASHTO-M82.

3. Aggregate: The aggregate required shall meet the following gradation requirements:

Sieve Size	Percent Passing
1/2 inch	100
3/8 inch	85-100
No. 8	0-10
No. 16	0-5
No. 200	0-2
Los Angeles Abrasion loss @ 1,500 revolutions per minute (ASTM C131)	40 (max.)
Percent crushed face	65 (min.)

EXECUTION

The construction of the asphalt pavement shall be constructed in accordance with the relevant provisions of Section 460 of the Massachusetts Department of Public Works Standard Specifications for Highways and Bridges and the following:

The equipment for spreading and finishing shall be mechanical, self-powered pavers, or motor graders

capable of spreading and finishing the mixture true to line, grade, width and crown.

The cutting edge of the motor grade blade should be sharp and must produce the required cross-section. The blade should be long enough to ensure finishing to close transverse tolerance. A 12 or 13 foot blade should be used.

The joints and linkage of the blade suspension system should be snug and free from excessive wear. Otherwise, the blade may vibrate or allow irregular pressure during operation and result in surface irregularities. Also the mold board and circle gear may settle when the machine stops or they may climb while spreading.

The motor grader should be heavy enough to hold the blade firmly and uniformly on the surface while spreading the mixture. The wheel base should be long enough to permit planning to close tolerance. On surface courses, the tires should have smooth treads to keep from leaving lug marks in the pavement. And the engine should be powerful enough to propel the machine without straining when spreading the mixture.

The use of any other type of equipment for spreading and finishing shall require the prior written approval of the Board or its Agent.

A prime coat of RS-1 shall be used at all interfaces of new pavement with original pavement. These construction joints shall also be back-sanded.

Compaction of Cold Mix:

1. Vibratory or static steel-tired rollers shall be used for initial rolling.

2. Pneumatic or steel-tired rollers shall be used for intermediate rolling.

3. Steel-tired rollers shall be used for finished rolling.

4. An application of choke aggregate shall be spread uniformly on the pavement surface at the rate of 6 pounds per square yard. This material shall be either coarse aggregate or dry sand.

Compaction of Hot Mix:

Pneumatic-tired and/or steel-tired rollers shall be used for compaction of the hot mix. A field compaction of 95 percent shall be required.

6. BELGIAN PAVING BLOCK PAVEMENT

SCOPE

These specifications cover the construction of a Belgian Paving Block pavement. The work shall consist of furnishing and setting granite Belgian Paving Block block pavement on a stone dust setting bed on a gravel base course in accordance with these specifications and in close conformity of the lines and grades shown on the Plans.

MATERIALS

Materials shall meet the requirements specified in the following descriptions and/or subsections of Division III of the Massachusetts Standard Specifications for Bridges and Highways.

Belgian Blocks. Belgian Paving Blocks shall be granite, basically light grey in color, free from seams and other structural imperfections or flaws which would impair its structural integrity, and of a smooth splitting appearance. Natural color variations characteristic of the deposit from which the paving blocks are obtained will be permitted. Cobblestone block shall be rectangular in shape with one good face and shall have uniform dimensions with the following limitations:

	Minimum	Maximum
Length	4 “	12 “
Width	3.5 “	4.5”
Depth	3.5”	4.5”

Sand Borrow. M1.04.0 Type A.

Portland Cement. M4.01.0

Stone Dust. Stone dust shall conform to the following gradation requirements:

Passing Sieve Size	**Percentage Passing**
No. 4	100
No. 50	90
No. 200	65

Gravel Borrow. M1.03.0 Type b

EXECUTION

The subbase below the stone dust setting bed shall be fine graded and thoroughly compacted (as required under Section 401 of the MSSBH).

The Belgian Paving Block will be set with the smooth side up. The top surface shall be approximately 4 inches by 8 inches. The joints between the Belgian Paving Blocks shall be set as shown on Plate 7.

The Belgian Paving Block shall be compacted and tamped by a method approved by the Board or its Agent. The pavement surface shall be tested with a 10-foot straight edge and laid parallel with the centerline and any variations exceeding 1/2 inch shall be reset to proper grade.

The Belgian Paving Block shall be swept with a sand/cement mixture (three parts sand, one part cement) and fogged with water. The pavement surface shall be vibrated to insure compactions between the joints. Additional joint filler of the sand/cement mixture shall be uniformly distributed as necessary to fill all of the voids. The process shall be repeated for a maximum of five (5) days until all joints are full.

7. COBBLESTONE PAVEMENT

SCOPE

These specifications cover the construction of cobblestone pavements. The work shall consist of furnishing and setting granite cobblestone pavers on a stone dust setting bed over a gravel base course in accordance with these specifications and in close conformity with the lines and grades shown on the plans or established by the Engineer.

MATERIALS

Materials shall meet the requirements specified in the following descriptions and/or sub-sections of Division III of the Massachusetts Standard Specifications for Bridges and Highways.

Cobblestones. Cobblestones shall be granite, of fairly uniform shape and color, free from cracks and other structural imperfections or flaws which would impair its structural integrity, and of a smooth appearance. Natural color variations, characteristic of the deposit source will be permitted. Cobblestones shall be similar to existing cobblestones on various downtown streets. Samples shall be submitted for approval by the Nantucket Planning Board.

Sand Borrow. M1.04.0 Type A.

Portland Cement. M1.01.0

Stone Dust. Stone dust shall conform to the following gradation requirements:

Passing Sieve Size	Percentage Passing
No. 4	100
No. 50	90
No. 200	65

Gravel Borrow. M1.03.0 Type b

CONSTRUCTION METHODS

The subbase below the stone dust setting bed shall be fine graded and thoroughly compacted (as required under section 401. of the M.S.S.B.H).

Cobblestones shall be carefully laid on a stone dust setting bed as shown on the plans, and shall be solidly rammed in position by hand.

The cobblestones shall be set with the long axis of each stone vertical to the roadway surface. The cobblestones shall be set such that each cobblestone is touching another cobblestone.

The cobblestones shall be compacted and tamped with a mechanical plate compactor or by another method approved by the Board or its Agent. After a sufficient area of pavement has been laid, the pavement surface shall be tested with a 10-foot straight edge and laid parallel with the centerline and any variations exceeding

1/2 inch shall be corrected and brought to proper grade. Any stones that become cracked during these procedures shall be removed and replaced.

The cobblestones shall be swept with a sand/cement mixture (three parts dry sand, one part cement) and fogged with water. The pavement surface shall be vibrated with a lightweight plate compactor to insure compaction between the joints. Additional joint filler of sand/cement mixture shall be uniformly distributed as necessary to fill all of the voids. The process shall be repeated for a maximum of five days until all the joints are full.

8. BRICK PAVEMENT

SCOPE

These specifications cover the construction of a Brick Paving Block Pavement. The work shall consist of furnishing and setting extruded fireclay Brick Paving Block pavement on a stone dust setting bed on a dense graded crushed stone and gravel base course in accordance with these specifications and in close conformity to the lines and grades shown on the plans.

MATERIALS

Materials shall meet the requirements specified in the following descriptions and/or subsections of Division III of the Massachusetts Standard Specifications for Bridges and Highways.

Brick Pavers. Brick Paving Block shall be for exterior paving, manufactured from extruded fireclay from shale and shall be fired to produce a dense paver and shall meet the requirements of ASTM C216-69-SW-FBS with water absorption not more than 5 percent with five-hour bail. Laminated brick will not be acceptable. Standard Face brick will not be acceptable.

All brick shall be batched type burned to provide the various colors by controlled atmosphere and temperature conditions, required to obtain a rustic blend (70 percent red and 30 percent brown to black). The brick shall be highly resistant to abrasion and shall have an average compressive strength of 8000 or more psi over a 100-cycle freeze-thaw test.

The brick shall be wire-cut to a size of 4 x 8 x 2.25 inches. Brick shall be delivered to the site on pallets. Samples shall be submitted for approval by the Nantucket Planning Board.

Sand Borrow. M1.04.0 Type A.

Portland Cement. M4.01.0

Stone Dust. Stone dust shall conform to the following gradation requirements:

Passing Sieve Size	Percentage Passing
No. 4	100
No. 50	95
No. 200	65

Dense Graded Crushed Stone. M2.01.7

Gravel Borrow. M1.03.0 Type b

CONSTRUCTION METHODS:

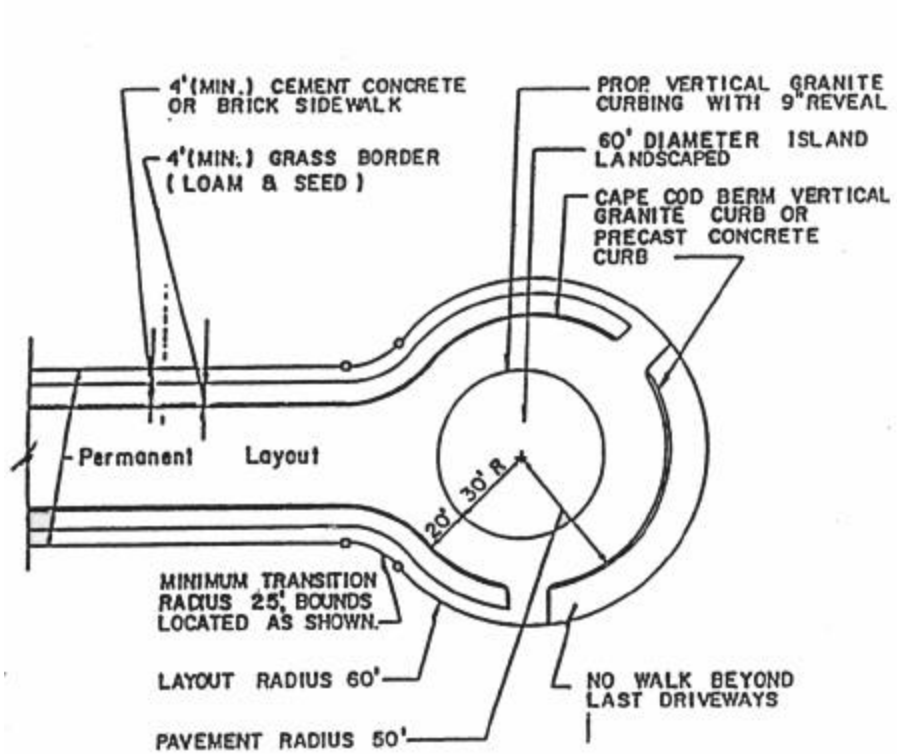
Each pavement layer shall be fine graded and thoroughly compacted (as required under Section 401. of the M.S.S.B.H.)

The Brick Pavers shall be laid true to lines and grades with joints of uniform thickness, all surfaces true and corners straight and plumb. Paving patterns shall be as shown on the plans or to match existing patterns, as directed by the Board or its Agent. Any patterns in which the alignment is not acceptable shall be promptly removed and reset.

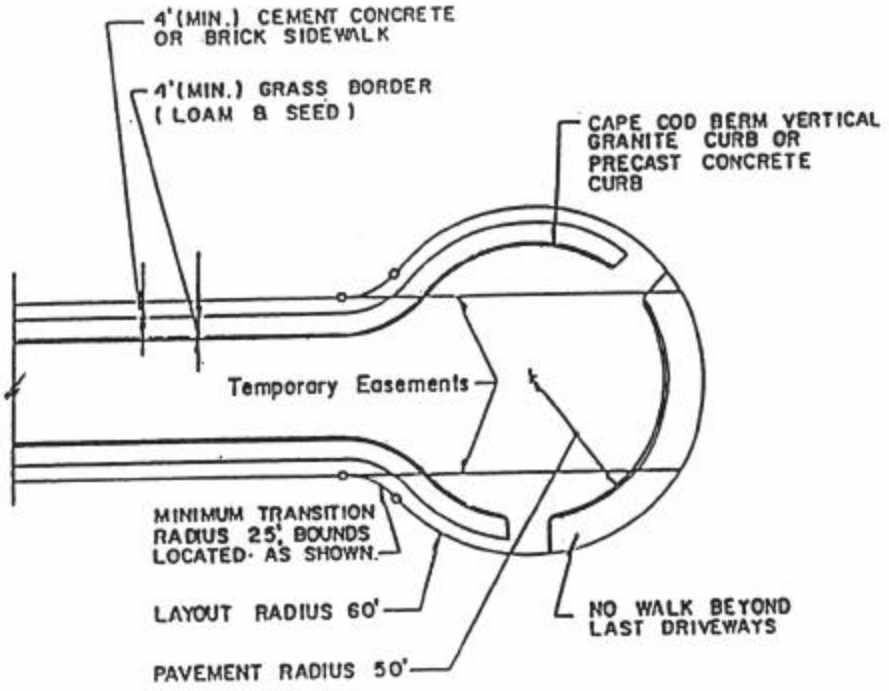
The Brick Pavers shall be compacted and tamped with a lightweight mechanical plate compactor or by another method approved by the Board or its Agent. After a sufficient area of pavement has been laid, the pavement surface shall be tested with a 10-foot straight edge and laid parallel with the centerline and variations exceeding 1/2 inch shall be corrected and brought to proper grade. Any pavers which become damaged during these procedures shall be promptly removed and reset.

The Brick Pavers shall be swept with a dry sand/cement mixture (three parts dry sand, one part cement) and fogged with water.

The pavement surface shall be vibrated with a lightweight plate compactor to insure compaction between joints. Additional joint filler sand/cement mixture shall be uniformly distributed as necessary to fill all of the voids. The process shall be repeated for a maximum of five days until all the joints are full, and all pavers are stabilized.

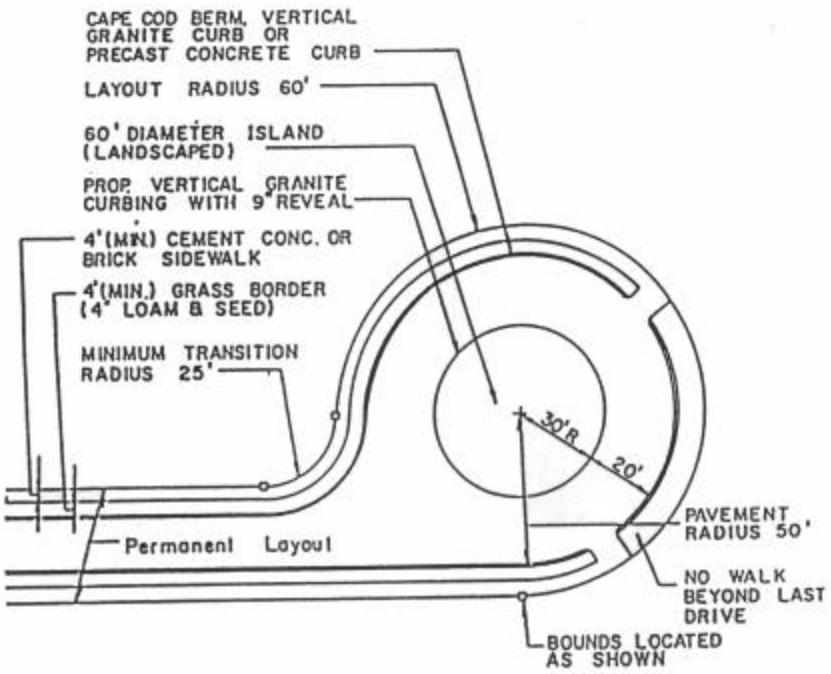


Typical Turning Circle Layout
(NTS)

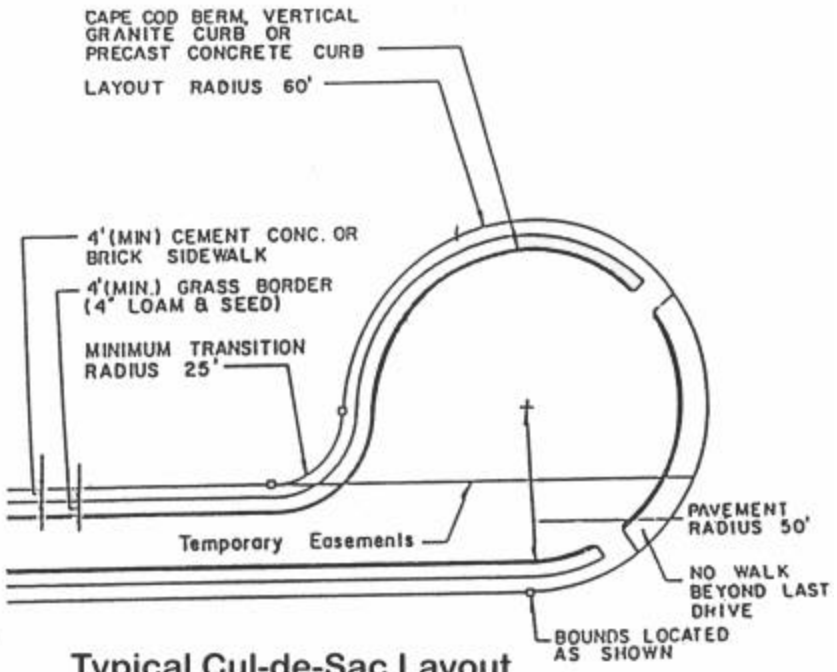


Typical Turning Circle Layout for Temporary Easements
(NTS)

Plate No. 1

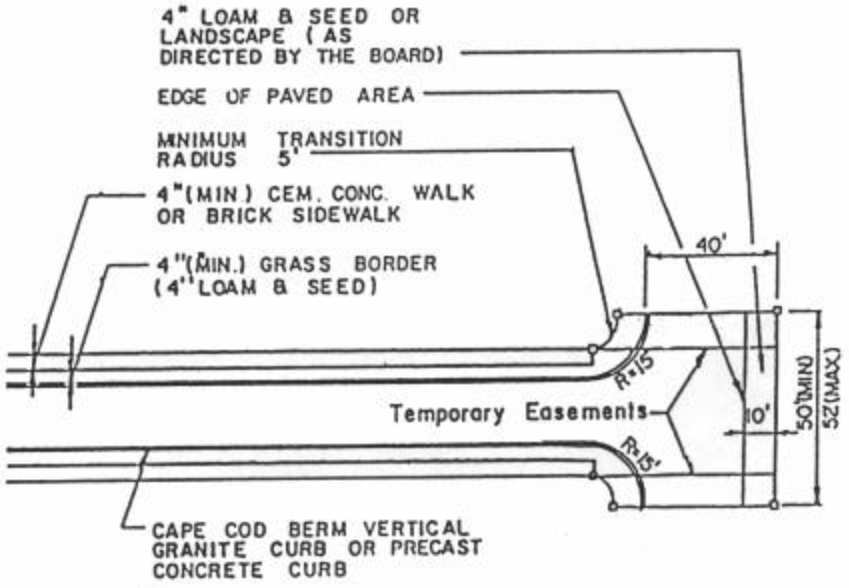


Typical Cul-de-Sac Layout
(NTS)

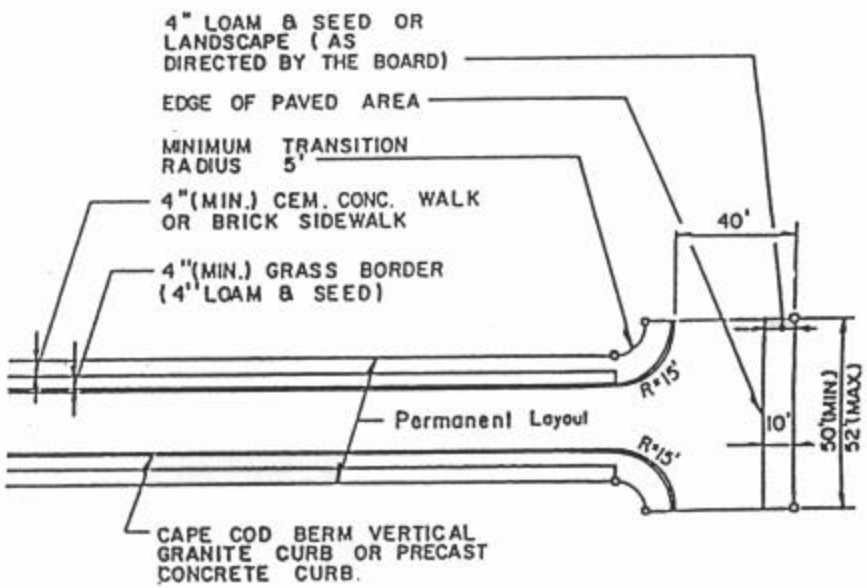


Typical Cul-de-Sac Layout
For Temporary Easements
(NTS)

Plate No. 2

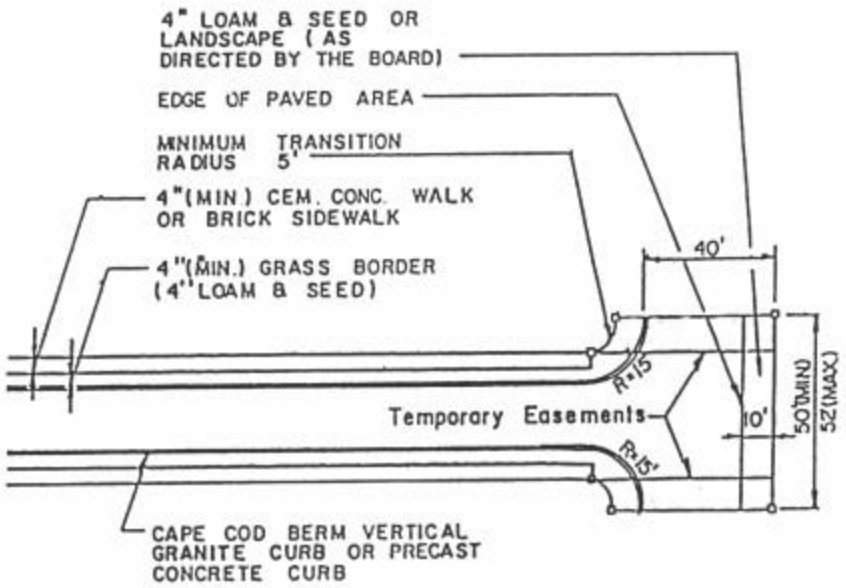


Typical Turning "L" Layout
(NTS)

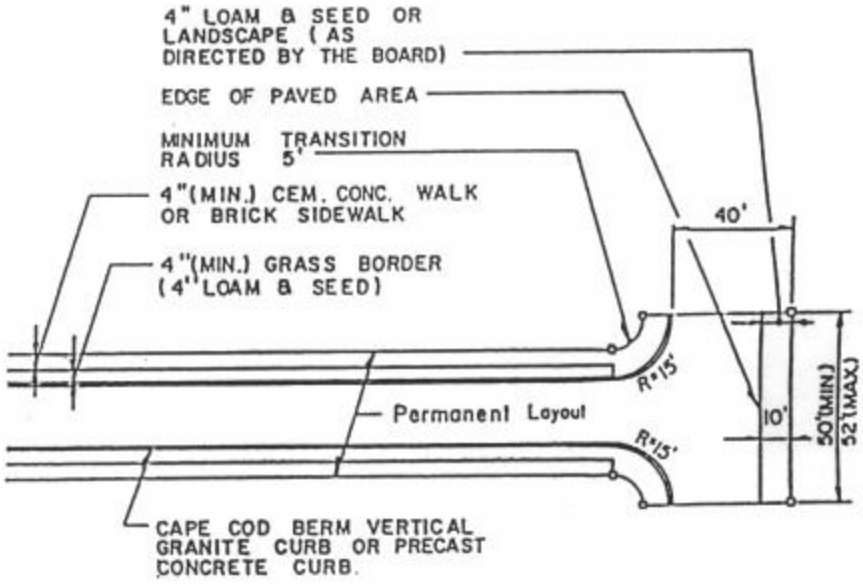


Typical Turning "L" Layout
For Temporary Easmenets
(NTS)

Plate No. 3

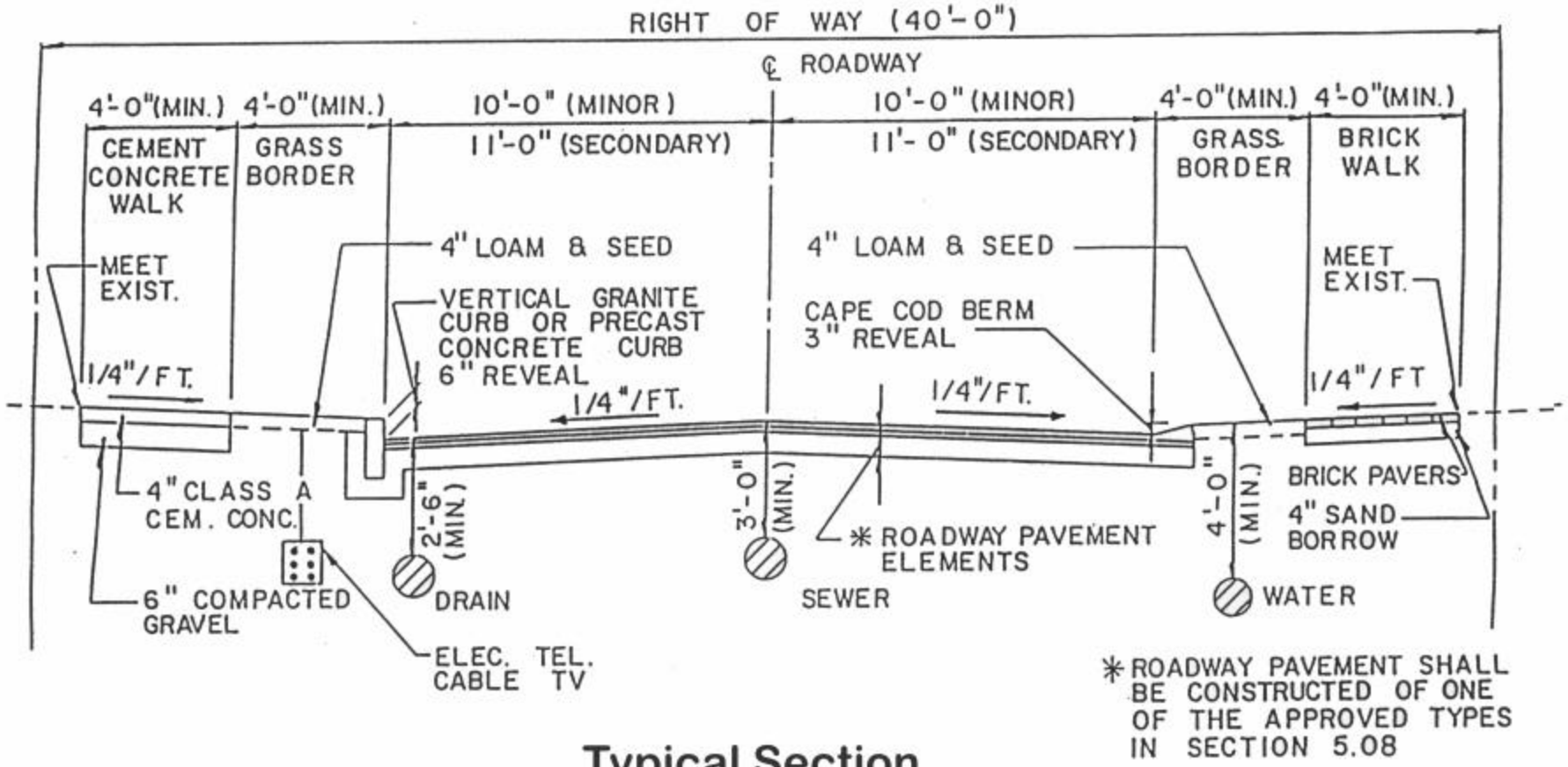


Typical Turning "T" Layout
For Temporary Easements
(NTS)



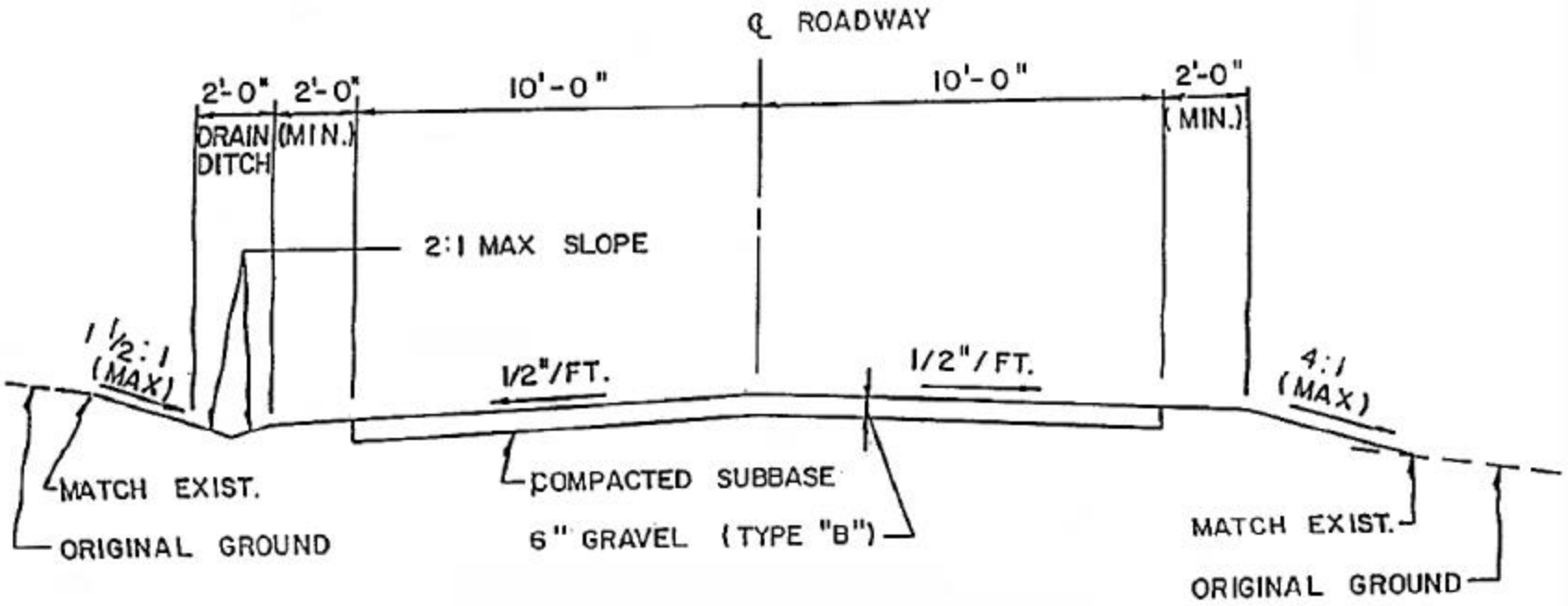
Typical Turning "T" Layout
(NTS)

Plate No. 4



Typical Section
Subdivision Roadway Design Standard
(NTS)

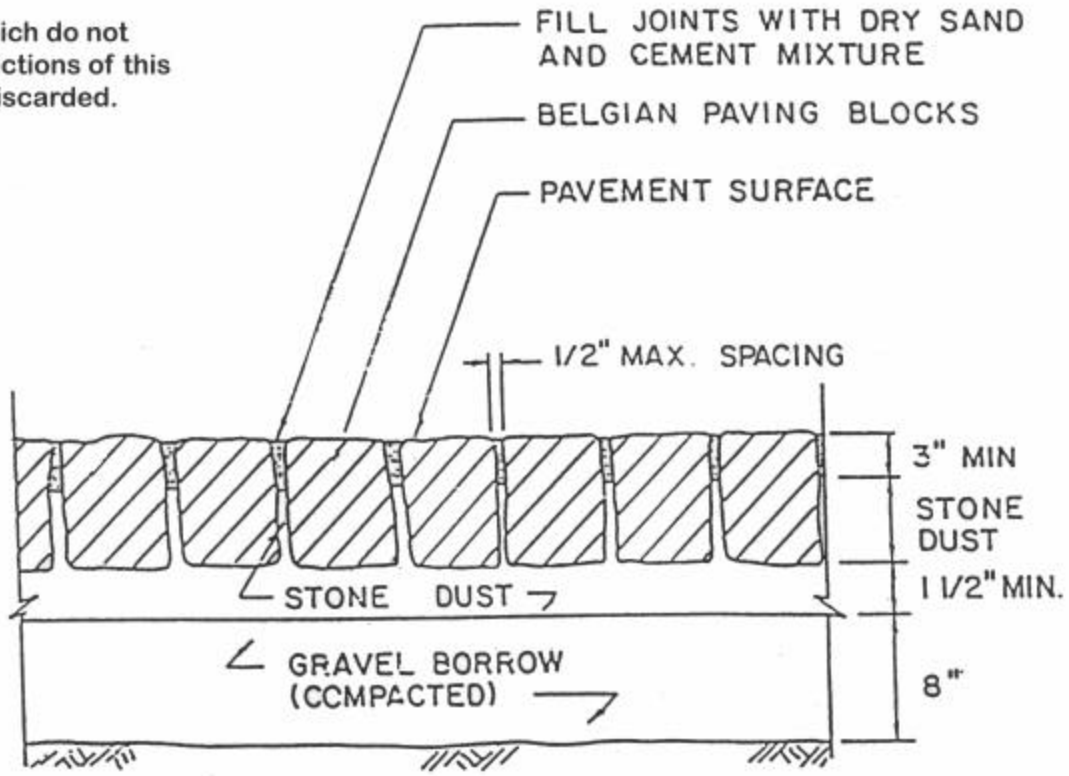
Plate No. 5



Typical Section
Stabilized Gravel Road
(NTS)

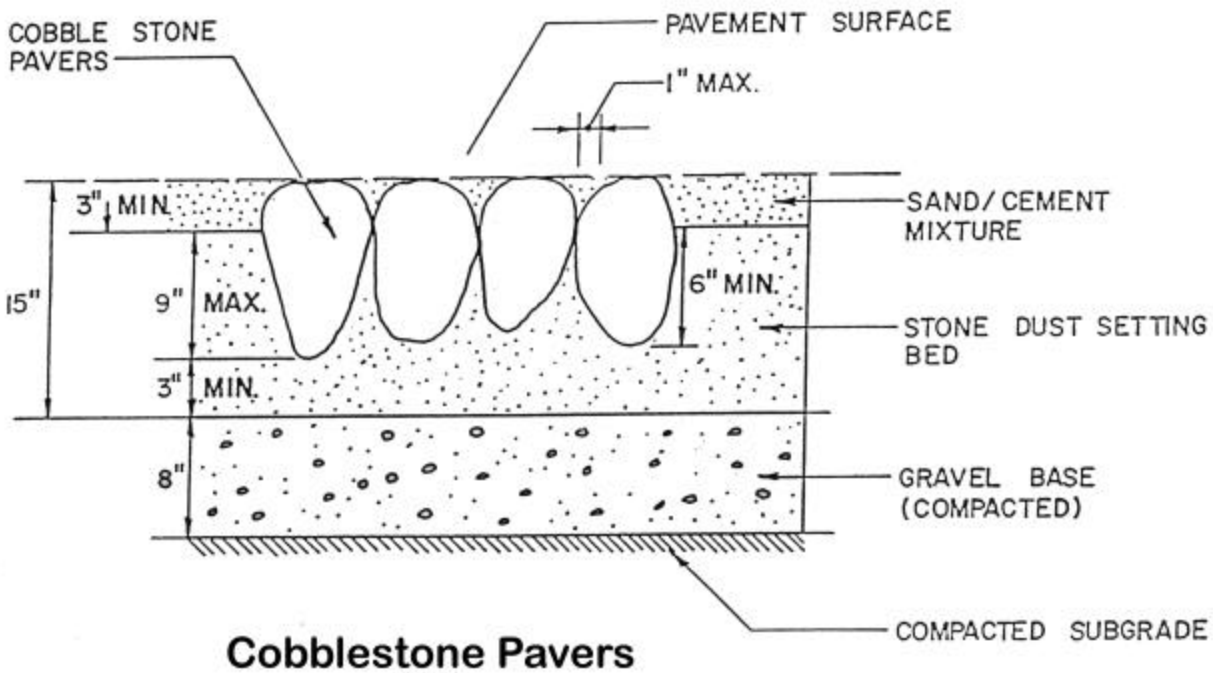
Plate No. 6

Note: Blocks which do not satisfy the restrictions of this detail shall be discarded.



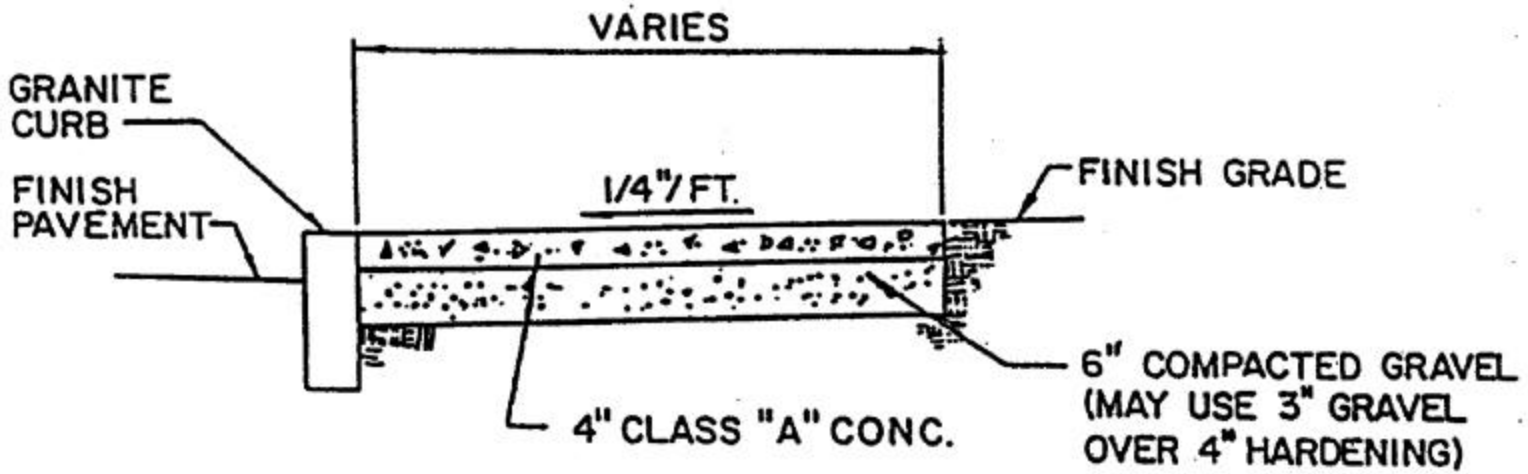
Typical Section
Belgian Block
Pavement Construction
(NTS)

Plate No. 7



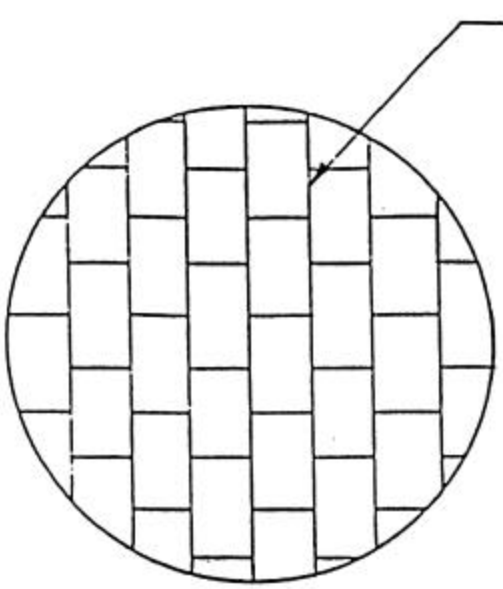
Cobblestone Pavers
(NTS)

Plate No. 8

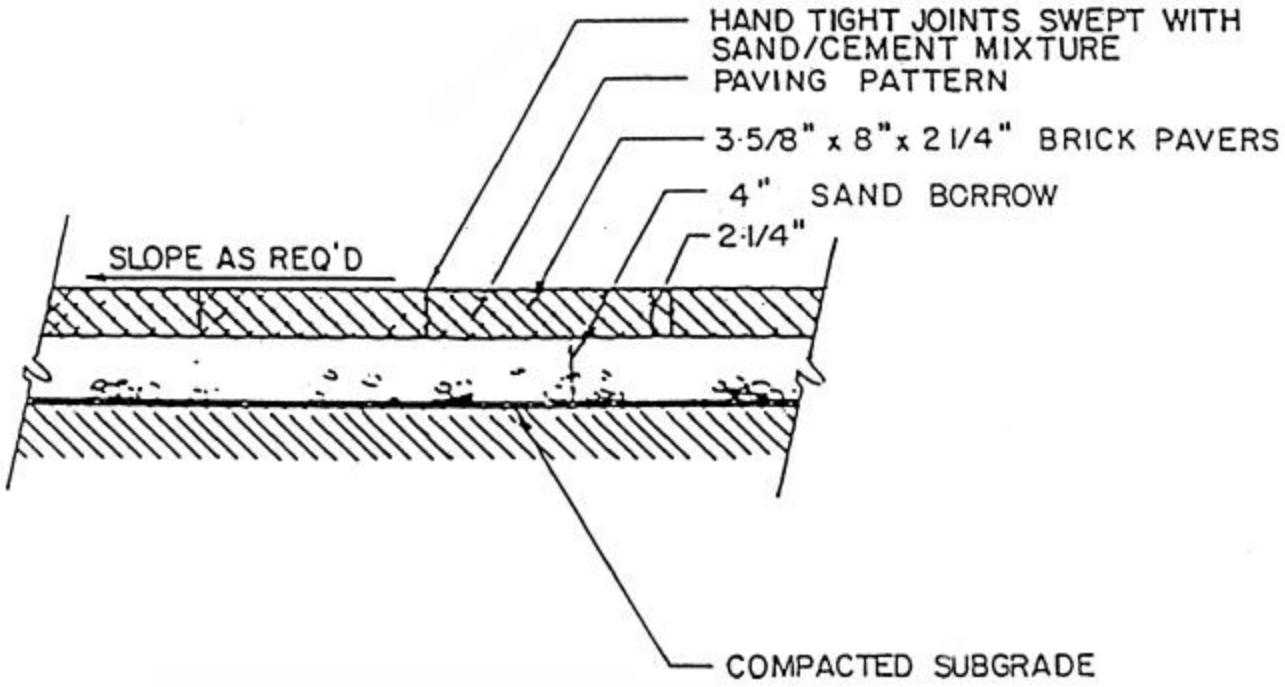


Typical Concrete
Sidewalk Section
(NTS)

Plate No. 9

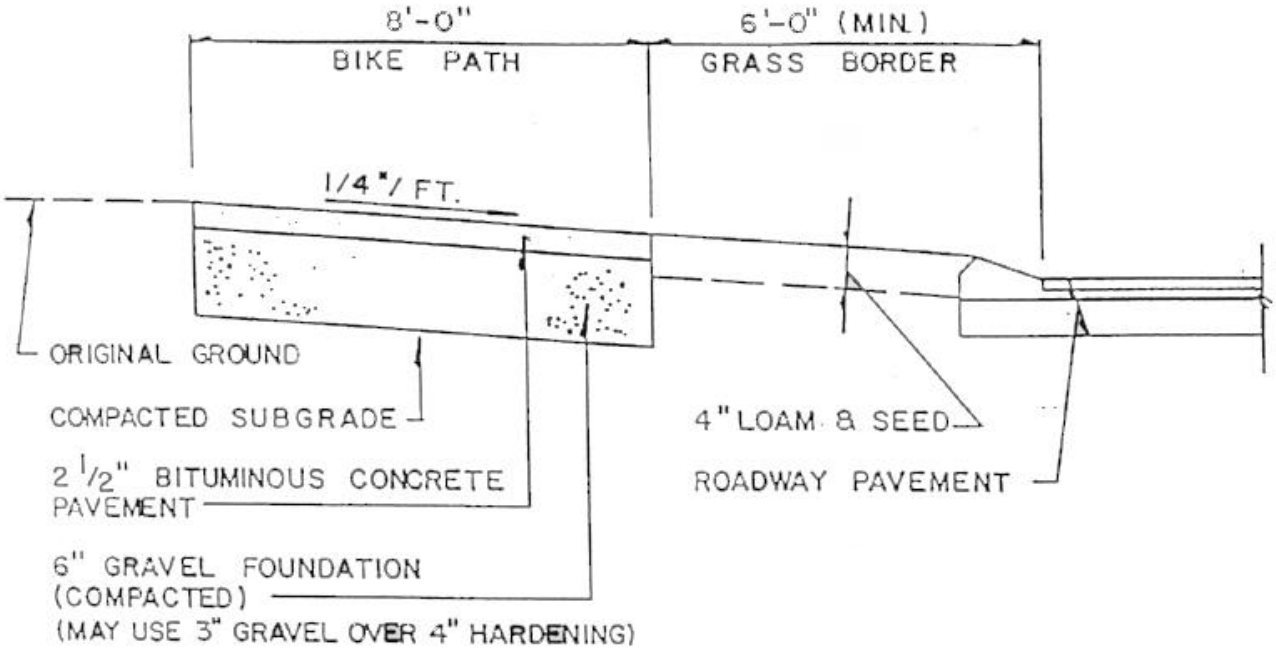


Paving Pattern Plan



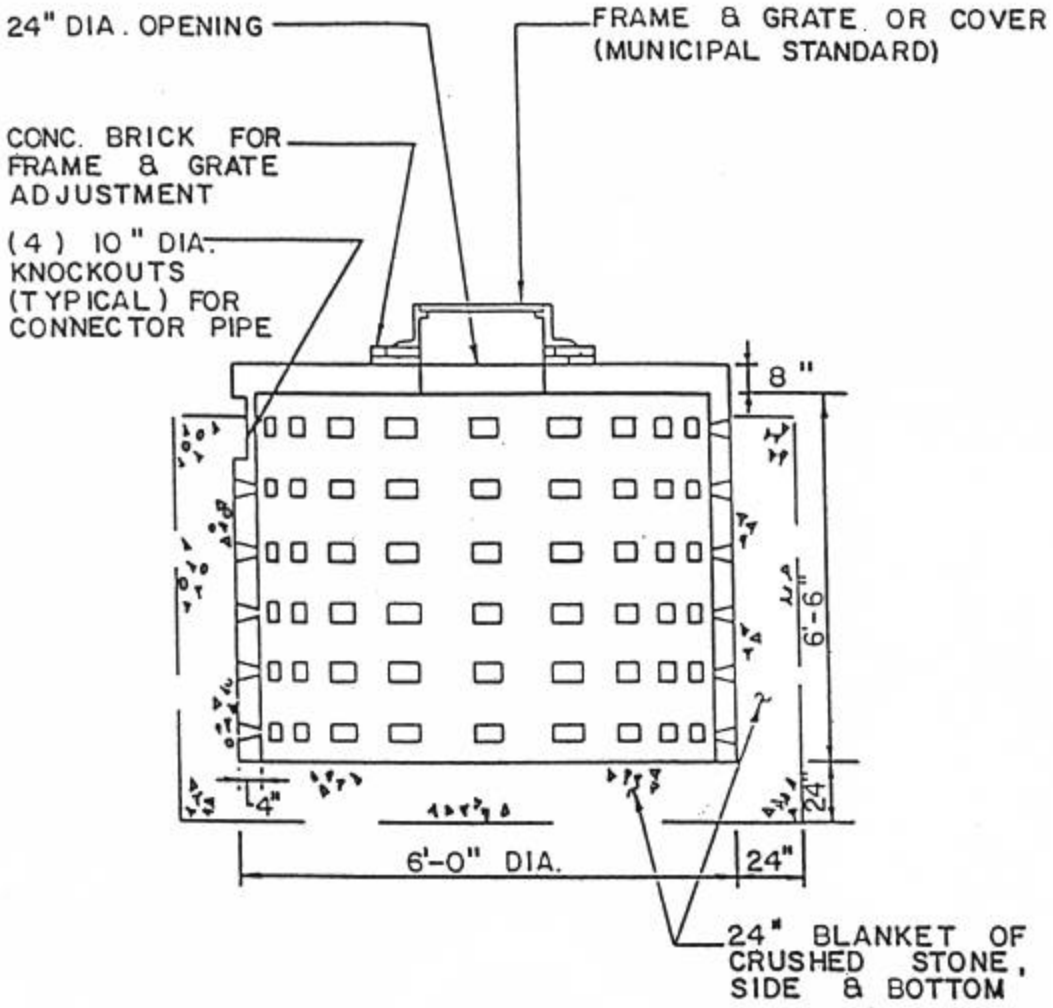
Typical Section
Brick Walkway Pavers
NTS

Plate No. 10



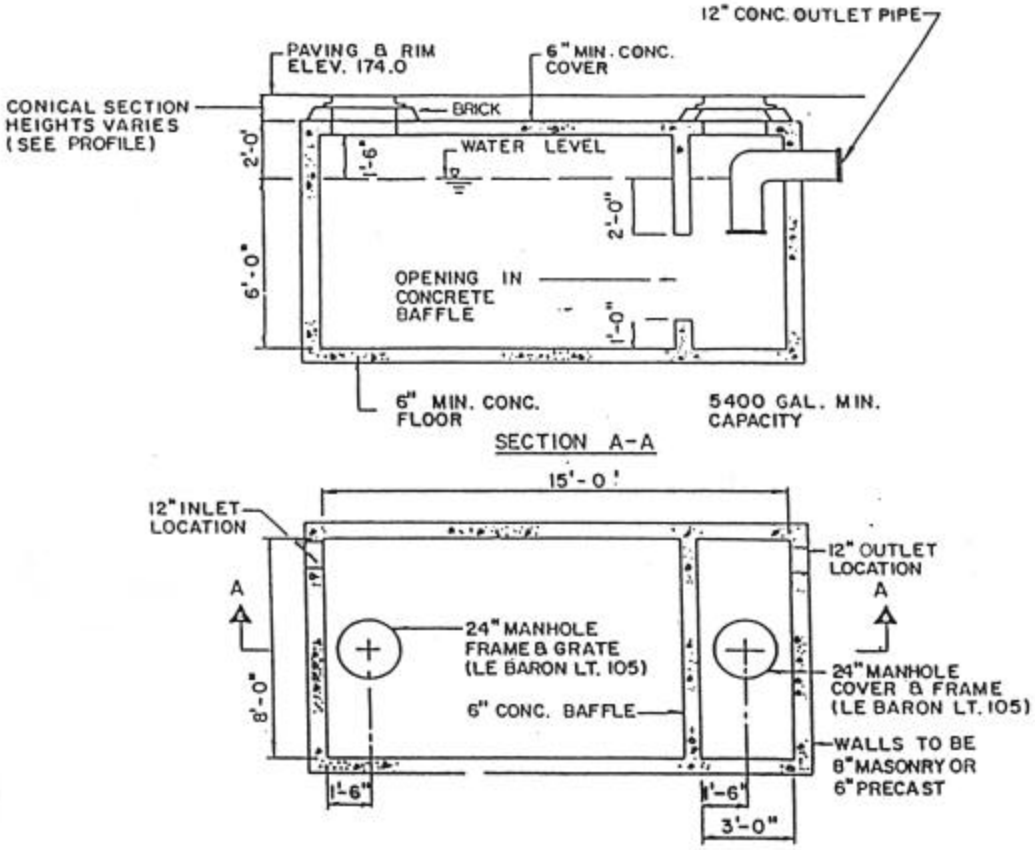
Typical Bike Path Section
(NTS)

Plate No. 11



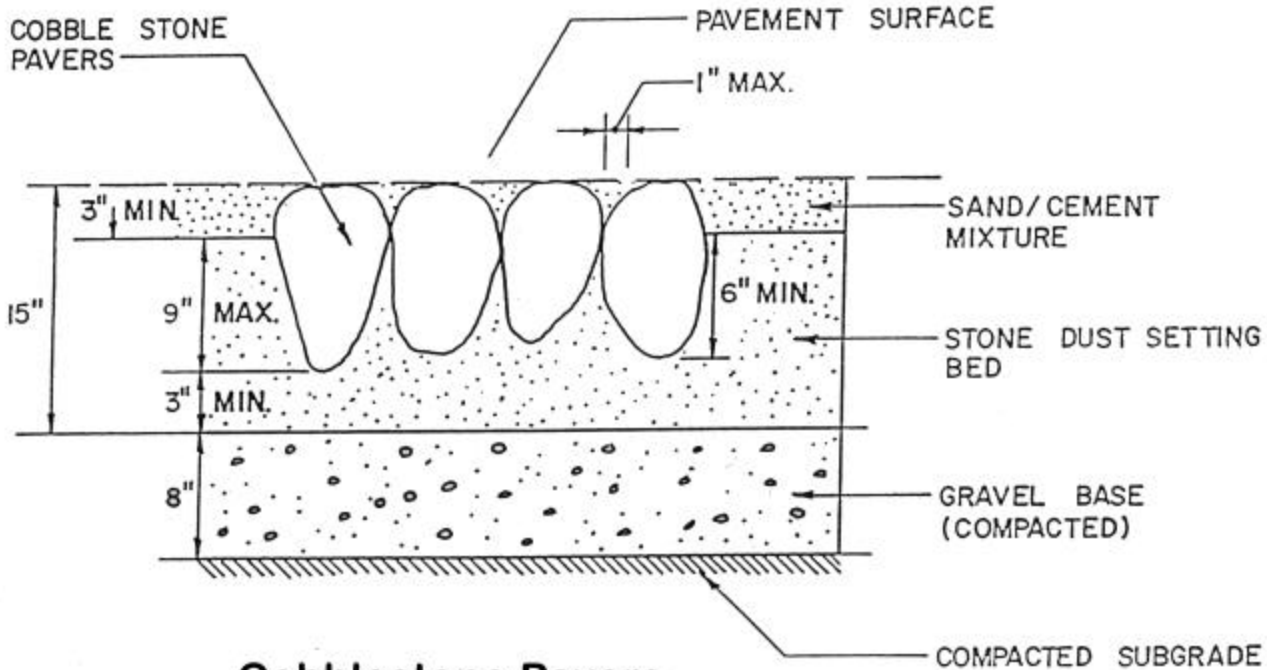
Proposed Precast Heavy Duty Leaching Basin
(NTS)

Plate No. 12



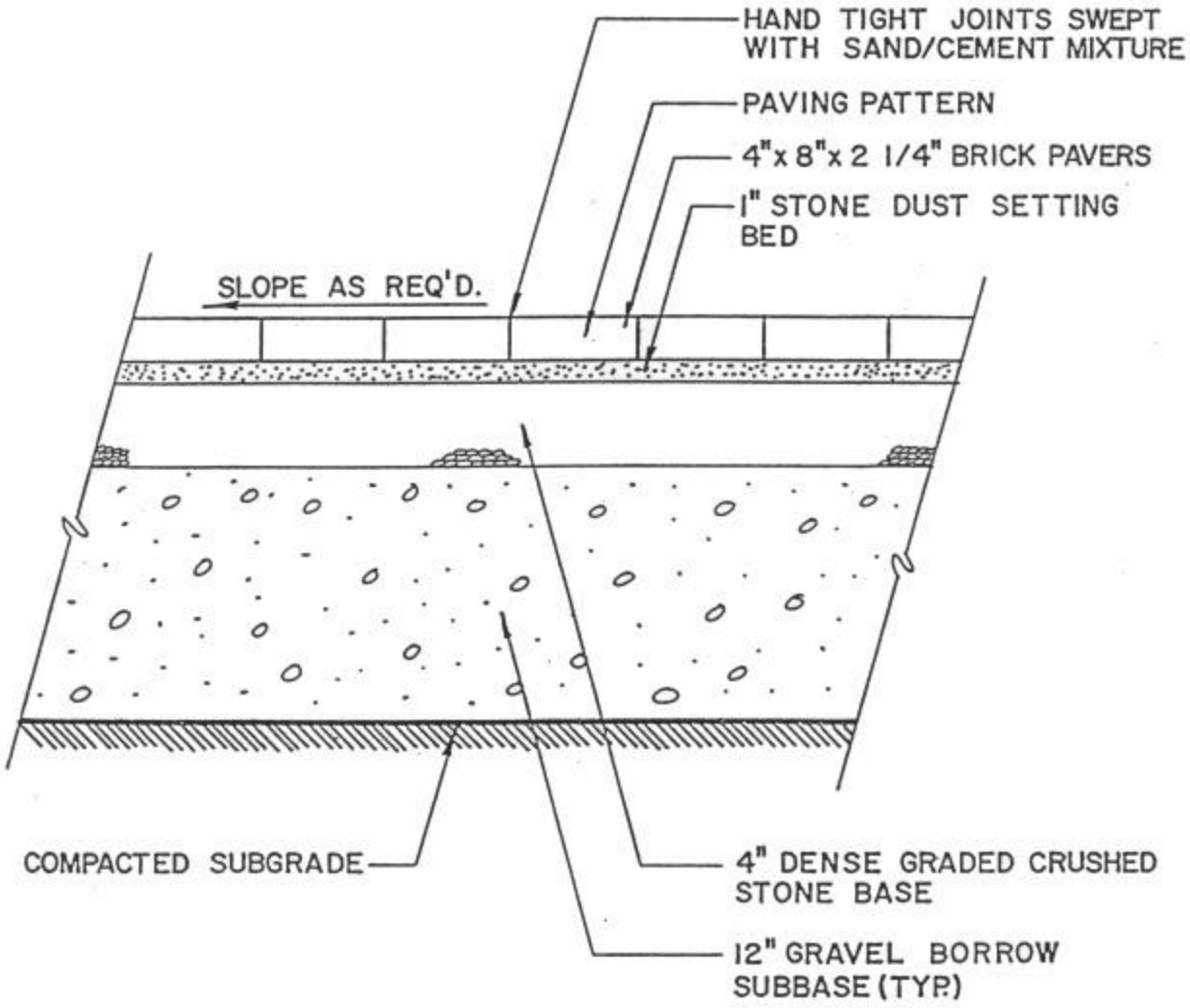
Gas and Oil Separator
(NTS)

Plate No. 13



Cobblestone Pavers
(NTS)

Plate No. 14

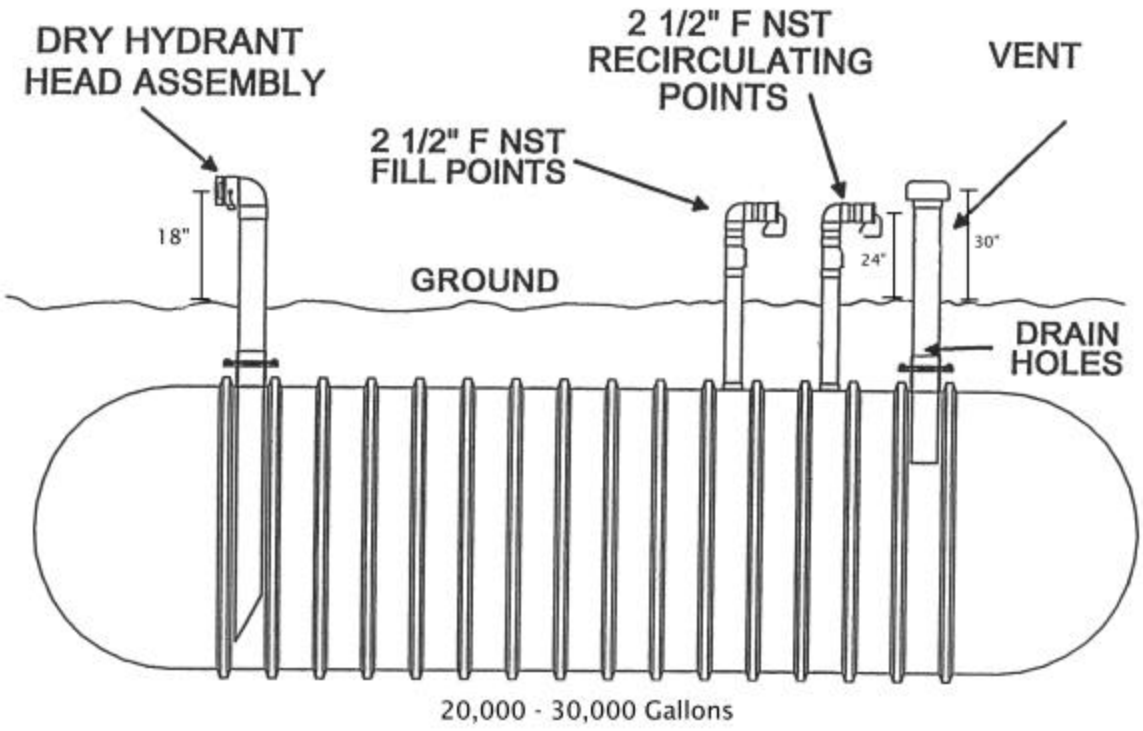


Brick Roadway Pavers
(NTS)

Plate No. 15

Emergency Water Supply Underground Tank

Typical Section (N.T.S.)



Hydrant and vent pipe must be 6 inch galvanized or PVC. Fill and recirculating points must be 3 inch galvanized or PVC. All pipes must be Schedule 40.

Plate No. 16